421775

FLOOD INSURANCE STUDY

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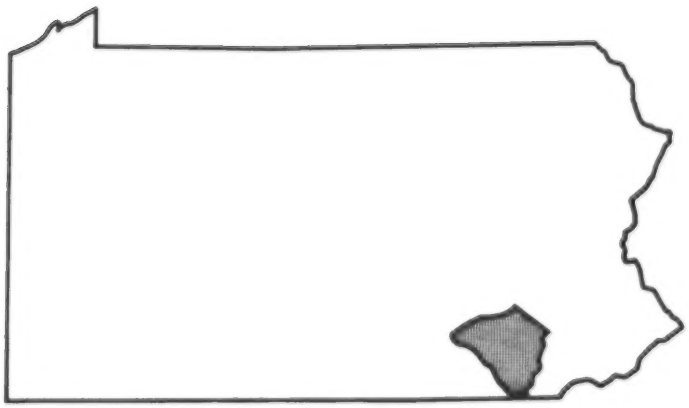
TOWNSHIP OF LITTLE BRITAIN, PENNSYLVANIA
LANCASTER COUNTY



OCTOBER 15, 1980

federal emergency management agency
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PUBLISHED SEPARATELY:

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY
TOWNSHIP OF LITTLE BRITAIN, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Little Britain, Lancaster County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Little Britain to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Roy F. Weston, Inc., for the Federal Insurance Administration, under Contract No. H-4818.

1.3 Coordination

Community base map selection and the identification of streams requiring detailed study were accomplished at the initial Consultation and Coordination Officer's (CCO) meeting held in May 1979, and attended by representatives of the township, the FIA, and Roy F. Weston, Inc., the study contractor.

This work was completed in September 1979. Survey and topographic data for this study were collected and compiled by Quinn and Associates, under subcontract to Roy F. Weston, Incorporated.

On May 15, 1980, the results of the study were reviewed at the final CCO meeting attended by the study contractor, the FIA, and officials and citizens of the Township of Little Britain.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Little Britain, Lancaster County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The West Branch Octoraro Creek was the only flooding source selected for detailed study. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through September 1984.

The following streams in the Township of Little Britain were studied by approximate methods: Octoraro Creek, Little Conowingo Creek, McCreary Run, several unnamed tributaries, and a portion of West Branch Octoraro Creek. Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FIA.

2.2 Community Description

The Township of Little Britain is located in southeastern Lancaster County, in southeastern Pennsylvania. It is situated near the center of a triangle whose points are Harrisburg to the northwest, Philadelphia to the east and Baltimore to the southwest. Little Britain is bordered to the southwest by the Township of Fulton, to the northwest by the Township of East Drumore and to the northeast

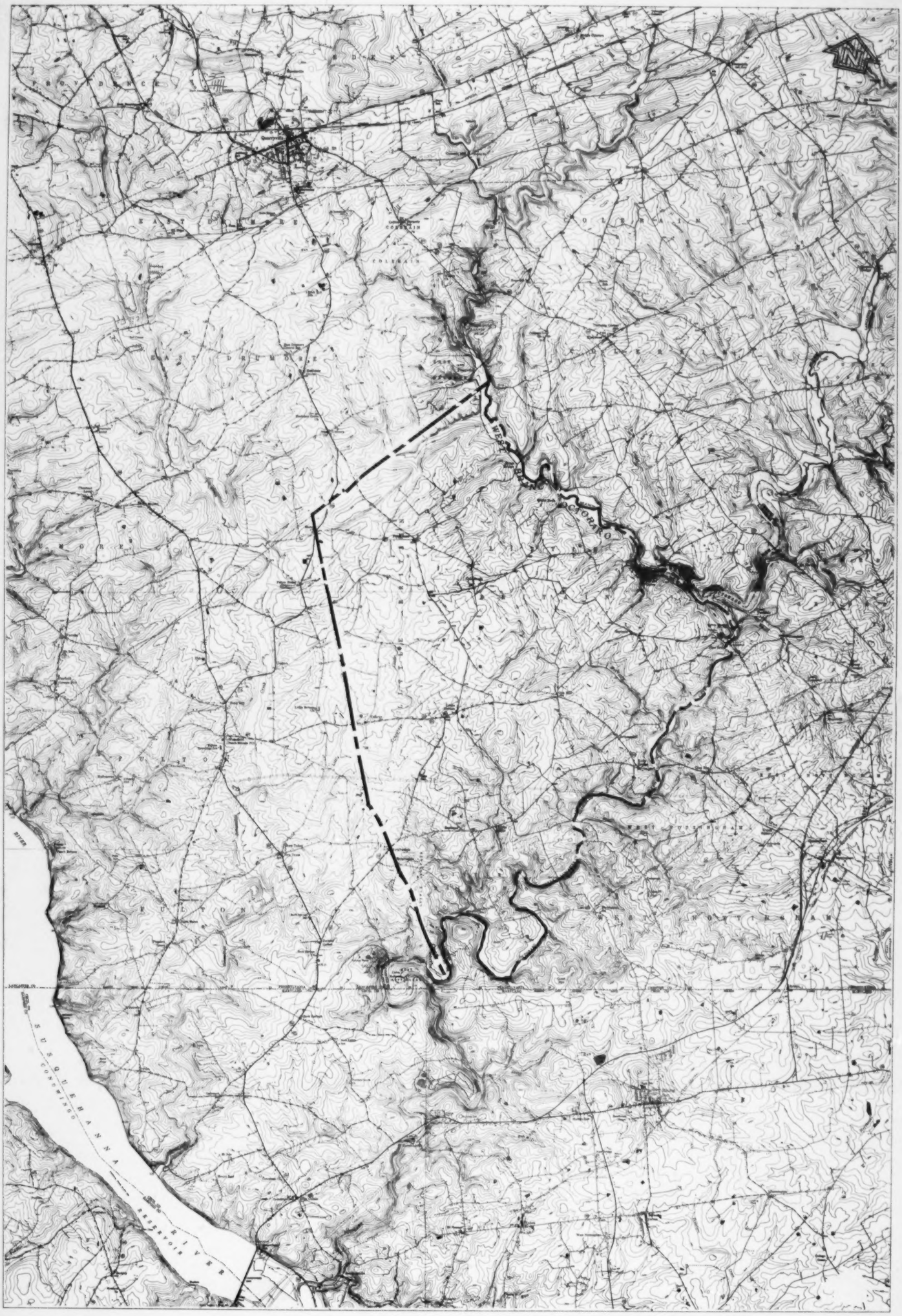


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LITTLE BRITAIN, PA
(LANCASTER CO.)

APPROXIMATE SCALE
7,000 0 7,000 14,000 21,000 FEET

VICINITY MAP

by the Township of Colerain. Octoraro Creek forms the southeastern border of Little Britain, separating it from the Townships of Lower Oxford and West Nottingham in Chester County.

The 1970 population of the township was 1,633, which represents an increase of 12.7 percent over the 1960 population (Reference 1). Population growth in this portion of Lancaster County has been much slower than that of the northern municipalities of the county.

The area now occupied by the Township of Little Britain was settled around 1700 by a group of Scotch-Irish immigrants from County Down. The land designated for the township was previously part of the Township of Drumore, one of the original townships of Lancaster County. In 1738, Drumore was divided in half, creating the Township of Little Britain. Little Britain was named in honor of Great Britain, the native place of most of the settlers. A further division of Little Britain occurred in 1844, resulting in the creation of the Township of Fulton.

Little Britain was one of the leading producers of general farm products, dairy products, and tobacco in Lancaster County. For many years, the "Wood Mine" in the township held the distinction for being the largest source of chromium in the world. This mine produced about 500 tons per month during the Civil War period.

Little Britain is located in the Piedmont Uplands, a province of the Appalachian Highlands. It is underlain by extensive formations of schist of the Lower Paleozoic Era, a metamorphic form of ancient sedimentary material; it includes the Wissahickon and Peter Creek schists and Peach Bottom slate. The soils of the area are of the Chester-Glenelg, Glenelg-Manor, Neshaminy-Aldino, and Whiteford-Cardiff associations.

The climate of the area is humid continental; it is characterized by moderate temperature changes, abundant and dependable precipitation, and a relatively long growing season. The pattern of mild winters and warm summers, in Lancaster County, results in an annual mean temperature of 52.5 degrees Fahrenheit (°F), a rainfall of 43 inches, and a snowfall of 24 inches.

The strategic location of Lancaster County on the expanding western fringe of the largest megalopolis in the nation (the highly urbanized corridor between Washington and Boston), determines the economic

way of life is changing to suburban due to the demands and pressures of expanding urbanization. The role of an agricultural economy is less dominant, and a shift in employment is occurring from agricultural to nonagricultural categories, primarily manufacturing.

2.3 Principal Flood Problems

Few major floods have occurred in Little Britain. The main storm season for the area is during the spring and summer; at this time, short periods of intense rainfall may cause a quick rise in the water depth of a stream and subsequent road flooding. To date, Little Britain has suffered little major flood damage from this type flooding.

The lack of severe flooding conditions in the township is attributed to the physical features of the watersheds and stream channels. However, of equal importance is that the flood plains and low-lying stream banks have been only lightly developed. Good farming methods, such as contour plowing, have also been effective factors in alleviating flooding, since a significant percentage of the total area in the community is comprised of agricultural lands.

Road flooding along streams in Little Britain is caused primarily by inadequate drainage. At some locations, flood levels are increased because of the limited carrying capacity of stream culverts. During storm events, trees, trash, and other debris may be washed away and carried downstream, collecting on bridges and obstructing stream flow. The accumulation of debris greatly reduces the limited capacity of bridges and culverts, and increases flooding into unpredictable areas, increases velocity of flow immediately downstream, and erodes culvert entrances and bridge approach embankments. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the stream and its structures were considered in this study.

2.4 Flood Protection Measures

The Township of Little Britain has no major structures intended solely for flood control. The township, however, uses the Flood Hazard Boundary Map to help guide flood plain development (Reference 2). The township supervisors have recently developed a new flood plain ordinance, which has been accepted by the Lancaster County Planning Commission.

The Lancaster County Planning Commission also provides assistance in the development of flood plain regulations, and has recently prepared sample flood plain zoning provisions designed to meet the requirements of the FIA.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for the flooding source studied in detail affecting the community.

There are no stream gages on the flooding source that was selected for study by detailed methods.

The method which was used to determine flood flows for the West Branch Octoraro Creek was the PSU III Method (Reference 3). This technique was developed for specific use in estimating flood peak flow rates for ungauged sites in Pennsylvania. The use of PSU III

is consistent with hydrologic studies performed by the Pennsylvania Department of Transportation in the design of bridges for small streams in Pennsylvania. However, the discharges obtained by the PSU III method for the West Branch Octoraro Creek, within the Township of Little Britain, were modified by a factor of 1.33. This factor is based on knowledge of the hydrologic conditions of the area.

A summary of drainage area-peak discharge relationships for West Branch Octoraro Creek is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WEST BRANCH OCTORARO CREEK					
Confluence with Octoraro Lake	41.8	8,800	13,200	15,400	19,360
Academy Road Bridge	38.6	8,300	12,450	14,525	18,260
Noble Road Bridge	35.3	7,800	11,700	13,560	17,160

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding source studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along this flooding source.

Cross-section data for streams in the area were obtained using aerial photogrammetric techniques; data for the below-water sections were obtained by field measurement data (Reference 4). All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Channel roughness factors (Manning's "n") used in the hydraulic analyses were assigned on the basis of field inspection and aerial photographs of flood plain areas (Reference 4). The assigned roughness factors for this study varied from 0.04 to 0.05 for channels, and 0.04 to 0.10 for overbanks. The high values are associated with thick tree and brush overbanks which exist along some portions in the study areas.

Water-surface elevations of floods were developed using the U. S. Army Corps of Engineers (COE) HEC-2 computer step-backwater program (Reference 5). The starting water-surface elevations for West Branch Octoraro Creek were developed by the slope/area method.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using photogrammetric survey maps at a scale of 1:12,000 with a contour interval of 5 feet (Reference 4). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The approximate flood boundaries were delineated using the Flood Hazard Boundary Map for the Township of Little Britain (Reference 2).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within

the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this report is presented to local agencies as a minimum standard that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
West Branch Octoraro Creek								
A	14,860	570	5,470	2.8	291.3	291.3	292.2	0.9
B	16,340	555	5,240	2.9	292.4	292.4	293.2	0.8
C	19,030	655	3,580	4.3	294.9	294.9	295.8	0.9
D	20,860	335	2,030	7.2	300.5	300.5	300.7	0.2
E	22,800	345	3,170	4.6	307.3	307.3	307.3	0.0
F	27,510	490	4,820	2.8	318.9	318.9	319.6	0.7
G	29,970	540	3,000	4.6	324.2	324.2	325.2	1.0
H	31,690	595	2,150	6.3	328.7	328.7	329.2	0.5
I	34,910	345	1,380	9.9	339.8	339.8	340.7	0.9

[1]Feet above dam on Octoraro Creek
[2]This width extends beyond corporate limits

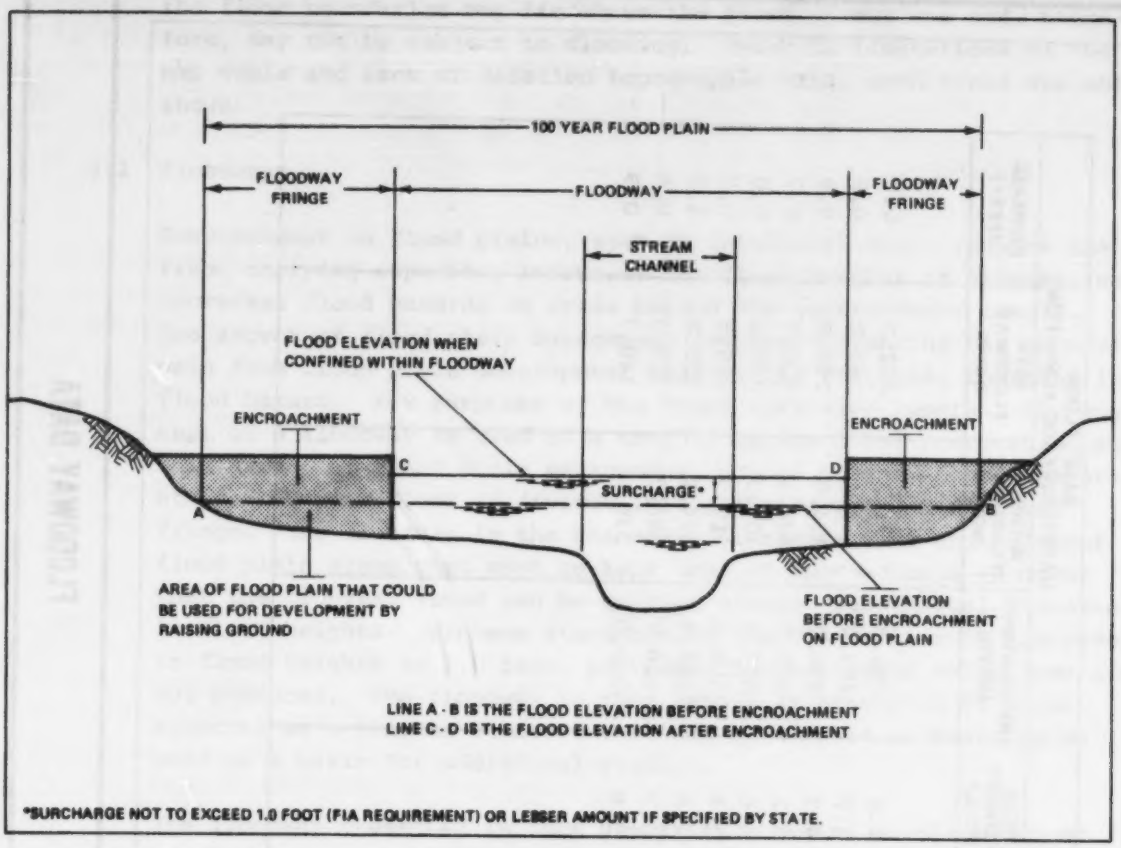
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LITTLE BRITAIN, PA
(LANCASTER CO.)

FLOODWAY DATA

WEST BRANCH OCTORARO CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for the flooding source affecting the Township of Little Britain.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding source of the Township of Little Britain are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Township of Little Britain was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

Zones A2, A5: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
West Branch Octoraro Creek							
Reach 1	05	-2.4	-0.8	+1.3	025	A5	Varies
Reach 2	05	-1.0	-0.3	+0.5	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LITTLE BRITAIN, PA
(LANCASTER CO.)

FLOOD INSURANCE ZONE DATA

WEST BRANCH OCTORARO CREEK

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Township of Little Britain is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

A Flood Insurance Study is currently being conducted for the Township of Colerain which borders the Township of Little Britain. The results of this study will match the Colerain study exactly (Reference 6).

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region III Office, Curtis Building, Sixth and Walnut Streets, Philadelphia, Pennsylvania 19106.

8.0 BIBLIOGRAPHY AND REFERENCES

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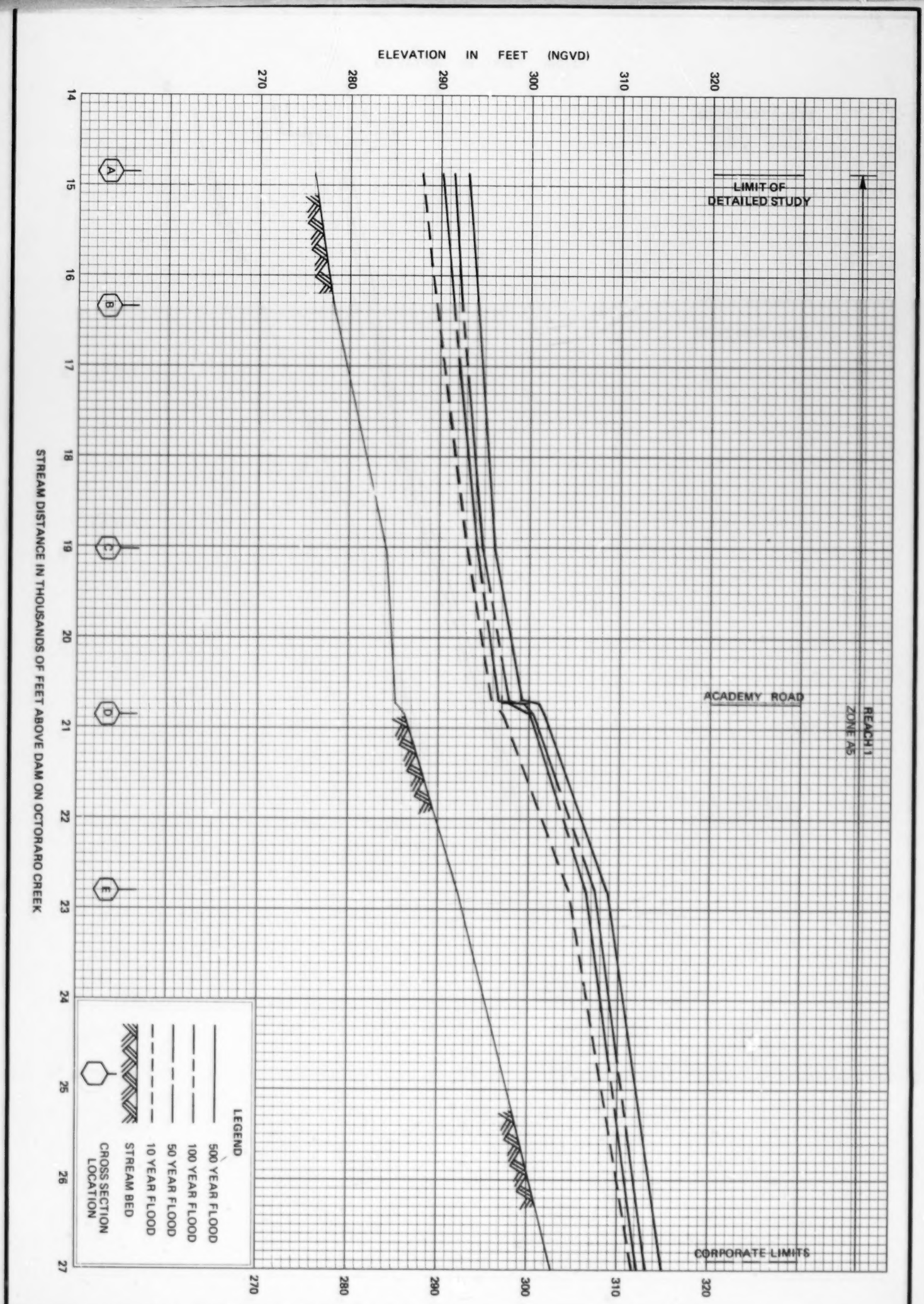

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LITTLE BRITAIN, PA
(LANCASTER CO.)

FLOOD PROFILES

WEST BRANCH OCTORARO CREEK

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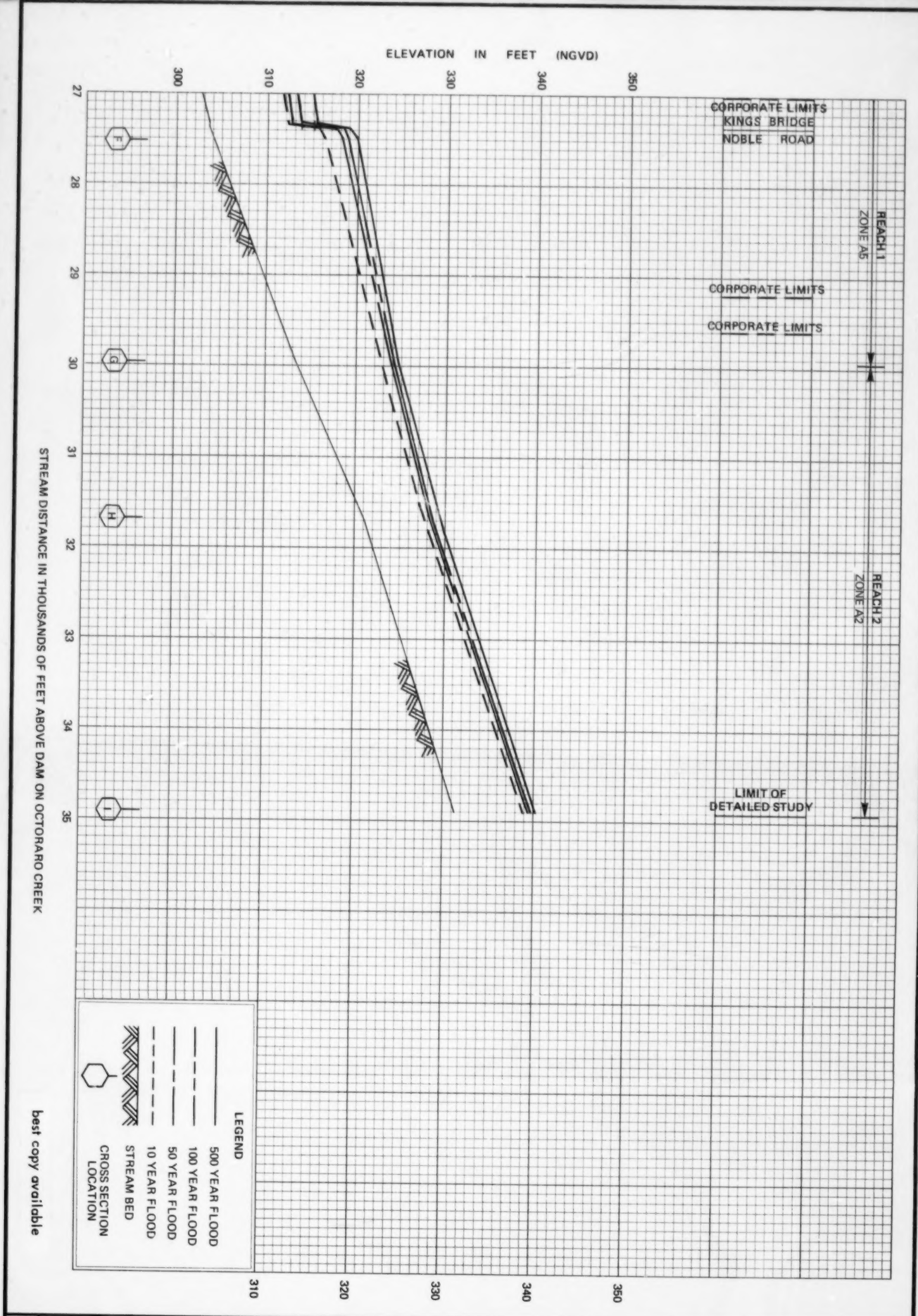

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FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWNSHIP OF LITTLE BRITAIN, PA
(LANCASTER CO.)

FLOOD PROFILES

WEST BRANCH OCTORARO CREEK